RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS

Meeting #4

Analysis of Uplink Data Rate Tolerance

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SUMMARY
This paper presents a brief analysis of the Uplink Data Rate tolerance imposed by the proposed 6*RS(85,65) uplink format.

Data Rate Tolerance:
The proposed UAT uplink format consists of 6 blocks of RS(85,65), preceded with a single 36-bit synchronization pattern. This differs from the present UAT prototypes in that each RS block would not be preceded by its own sync pattern.

The single-sync pattern requirement has an impact on the data rate tolerance. Allowing for 1/10 of a bit clock drift over the duration of the message: 6 * 85 * 8 = 4080 bits per uplink, divided into 1/10 of a bit, or +/- 24 PPM for the link. We want to avoid requiring an expensive reference oscillator in the avionics. That limits the accuracy of the avionics to +/- 20 PPM.

Alternative 1:
If the data rate accuracy is split evenly between the avionics and the base station, then each side has to be about +/- 10 PPM. That's expensive for both sides, and a significant cost issue for the avionics. The base station can more easily tolerate the higher costs.

Alternative 2:
If instead the ground station has a better accuracy clock than the avionics (i.e. $\leq$ 2 PPM), you could use almost the entire error budget in the avionics. That meets the +/- 20 PPM goal for the avionics.

Another option would be to lock the data rate to GPS 1PPS timing signal. This would yield a "free" high accuracy clock, but it would only guarantee uplink reception when the GPS 1PPS timing was valid. That's probably not a good thing.

A benefit to Alternative 2 is that existing prototype UAT avionics (i.e. Capstone) can be readily updated for MOPS compatibility by a software-only change.

Summary:
The single-sync method would work, with the provision that base station data rate tolerance is required to be 2 PPM or better, as discussed in Alternative 2 above.